

Advanced Embedded Software Development

Homework 3

Submission by-Smitha Bhaskar

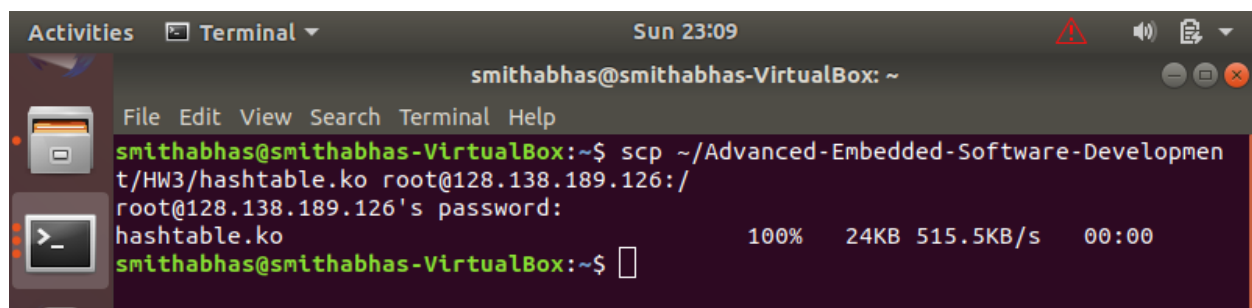
1. Ethernet login :

```
eth0      Link encap:Ethernet  HWaddr 04:A3:16:E8:4E:B9
          inet addr:128.138.189.126  Bcast:128.138.189.255  Mask:255.255.255.0
          inet6 addr: fe80::d7e5:14ad:7559:d392/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:17148 errors:0 dropped:0 overruns:0 frame:0
          TX packets:437 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1406090 (1.3 MiB)  TX bytes:52472 (51.2 KiB)
          Interrupt:46

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

# █
```

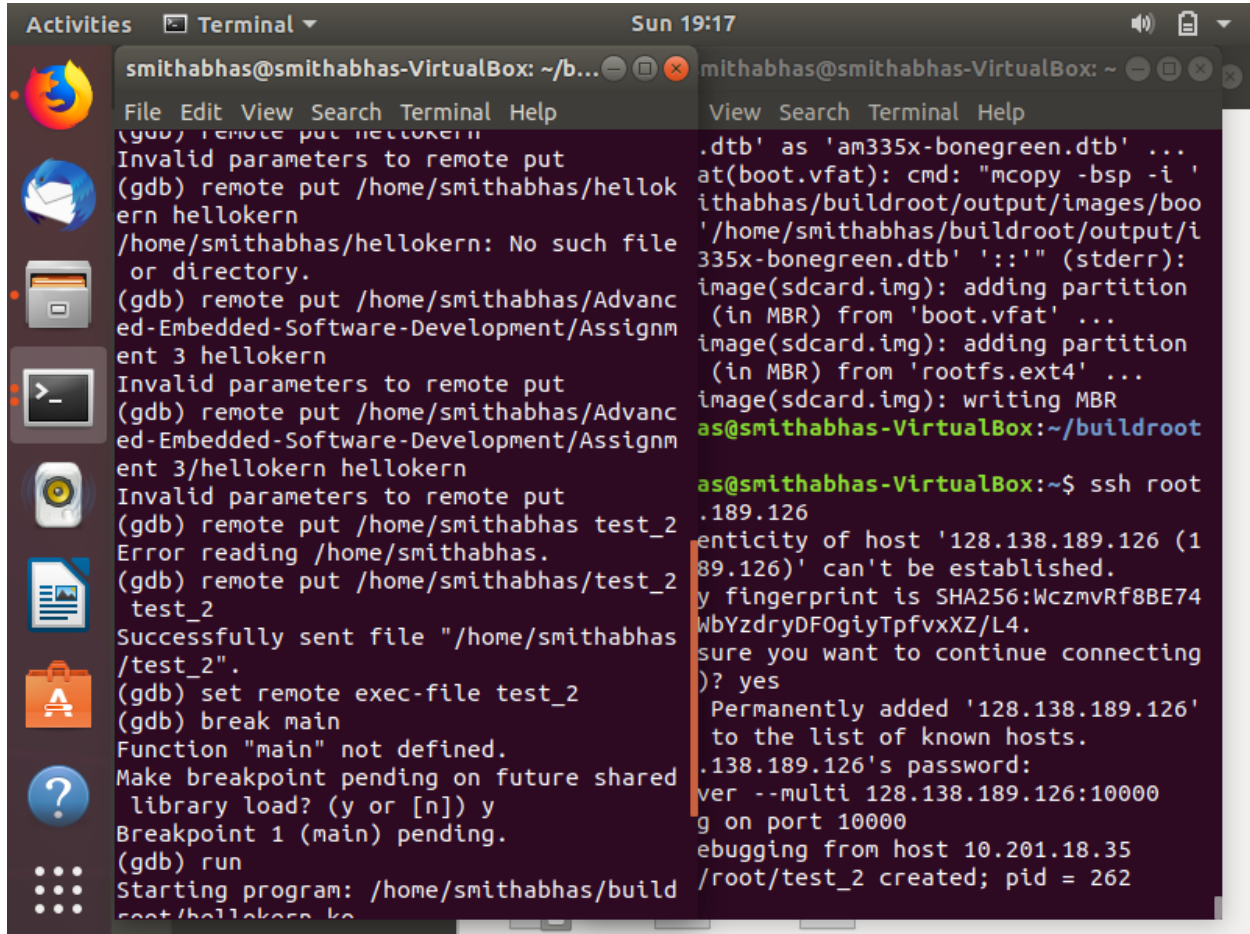
scp:



The screenshot shows a terminal window titled "Terminal" with the date "Sun 23:09". The user is logged in as "smithabhas@smithabhas-VirtualBox: ~". The terminal displays the following command and output:

```
smithabhas@smithabhas-VirtualBox:~$ scp ~/Advanced-Embedded-Software-Development/HW3/hashtable.ko root@128.138.189.126:/
root@128.138.189.126's password:
hashtable.ko                                100% 24KB 515.5KB/s 00:00
smithabhas@smithabhas-VirtualBox:~$ █
```

GDB:

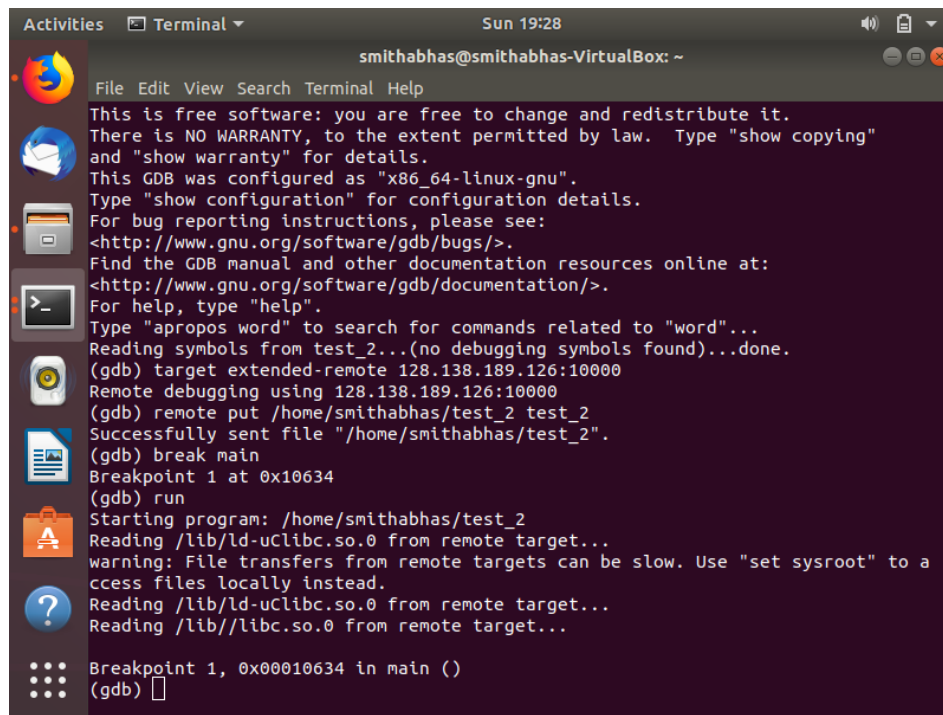


The screenshot shows a terminal window with two panes. The left pane shows GDB commands and their output, and the right pane shows the output of an SSH command.

```
smithabhas@smithabhas-VirtualBox: ~/b...
File Edit View Search Terminal Help
(gdb) remote put netlocern
Invalid parameters to remote put
(gdb) remote put /home/smithabhas/hellokern
ern hellokern
/home/smithabhas/hellokern: No such file
or directory.
(gdb) remote put /home/smithabhas/Advanc
ed-Embedded-Software-Development/Assignm
ent 3/hellokern hellokern
Invalid parameters to remote put
(gdb) remote put /home/smithabhas/Advanc
ed-Embedded-Software-Development/Assignm
ent 3/hellokern hellokern
Invalid parameters to remote put
(gdb) remote put /home/smithabhas test_2
Error reading /home/smithabhas.
(gdb) remote put /home/smithabhas/test_2
test_2
Successfully sent file "/home/smithabhas
/test_2".
(gdb) set remote exec-file test_2
(gdb) break main
Function "main" not defined.
Make breakpoint pending on future shared
library load? (y or [n]) y
Breakpoint 1 (main) pending.
(gdb) run
Starting program: /home/smithabhas/build
root/hellokern ke

mithabhas@smithabhas-VirtualBox: ~
View Search Terminal Help
.dtb' as 'am335x-bonegreen.dtb' ...
at(boot.vfat): cmd: "mcopy -bsp -i '
ithabhas/buildroot/output/images/boo
'/home/smithabhas/buildroot/output/i
335x-bonegreen.dtb' '::'" (stderr):
image(sdcard.img): adding partition
(in MBR) from 'boot.vfat' ...
image(sdcard.img): adding partition
(in MBR) from 'rootfs.ext4' ...
image(sdcard.img): writing MBR
as@smithabhas-VirtualBox:~/buildroot
as@smithabhas-VirtualBox:~$ ssh root
.189.126
enticity of host '128.138.189.126 (1
89.126)' can't be established.
y fingerprint is SHA256:WczmVrF8BE74
WbYzdryDF0giyTpfvXXZ/L4.
sure you want to continue connecting
)? yes
Permanently added '128.138.189.126'
to the list of known hosts.
.138.189.126's password:
ver --multi 128.138.189.126:10000
g on port 10000
ebugging from host 10.201.18.35
/root/test_2 created; pid = 262
```

breakpoint:

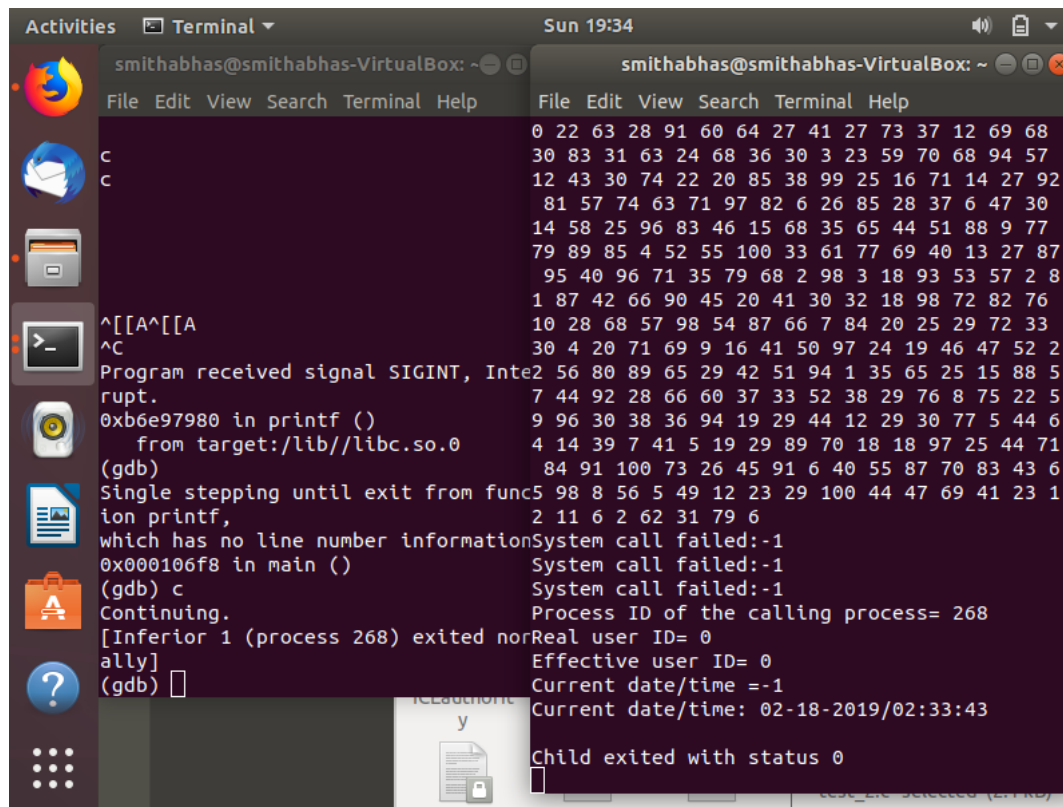


The screenshot shows a terminal window titled "Terminal" with a subtitle "smithabhas@smithabhas-VirtualBox: ~". The window contains the following text:

```
File Edit View Search Terminal Help
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.  Type "show copying"
and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.
For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from test_2...(no debugging symbols found)...done.
(gdb) target extended-remote 128.138.189.126:10000
Remote debugging using 128.138.189.126:10000
(gdb) remote put /home/smithabhas/test_2 test_2
Successfully sent file "/home/smithabhas/test_2".
(gdb) break main
Breakpoint 1 at 0x10634
(gdb) run
Starting program: /home/smithabhas/test_2
Reading /lib/ld-uClibc.so.0 from remote target...
warning: File transfers from remote targets can be slow. Use "set sysroot" to a
ccess files locally instead.
Reading /lib/ld-uClibc.so.0 from remote target...
Reading /lib//libc.so.0 from remote target...

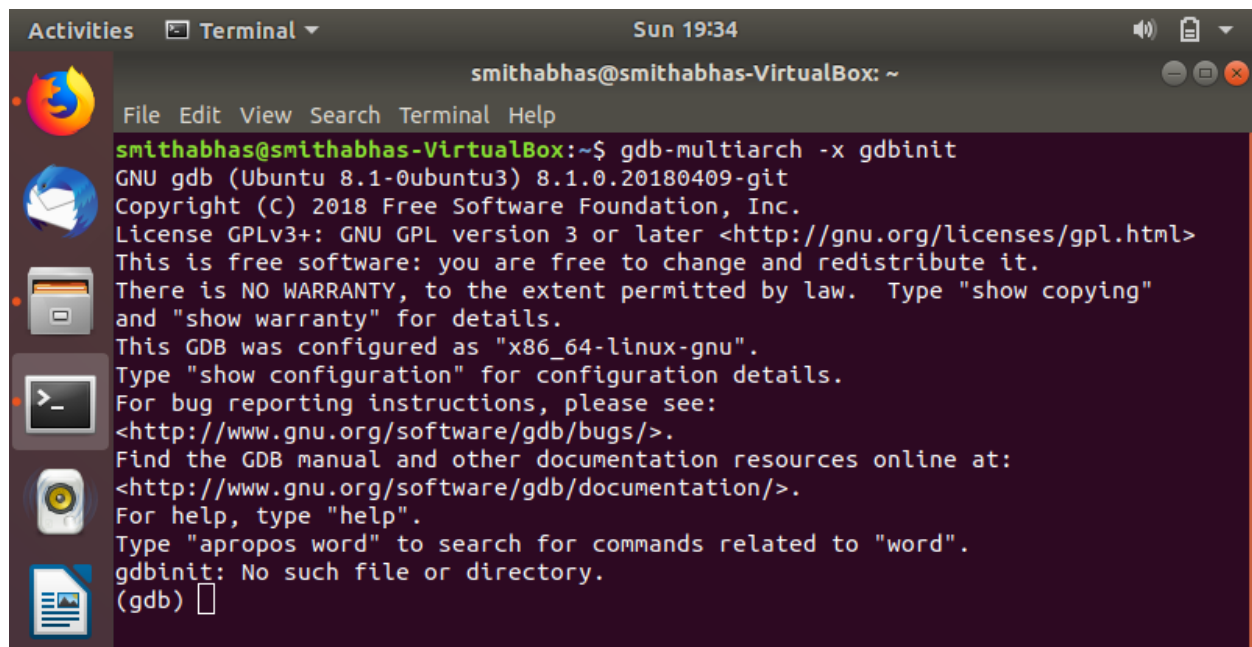
Breakpoint 1, 0x00010634 in main ()
(gdb) 
```

step down in gdb:



```
smithabhas@smithabhas-VirtualBox: ~  
File Edit View Search Terminal Help  
c  
c  
^[[A^[[A  
^C  
Program received signal SIGINT, Interrupt.  
0xb6e97980 in printf ()  
    from target:/lib//libc.so.0  
(gdb)  
Single stepping until exit from function printf,  
which has no line number information: 0x000106f8 in main ()  
(gdb) c  
Continuing.  
[Inferior 1 (process 268) exited normally]  
(gdb)   
0 22 63 28 91 60 64 27 41 27 73 37 12 69 68  
30 83 31 63 24 68 36 30 3 23 59 70 68 94 57  
12 43 30 74 22 20 85 38 99 25 16 71 14 27 92  
81 57 74 63 71 97 82 6 26 85 28 37 6 47 30  
14 58 25 96 83 46 15 68 35 65 44 51 88 9 77  
79 89 85 4 52 55 100 33 61 77 69 40 13 27 87  
95 40 96 71 35 79 68 2 98 3 18 93 53 57 2 8  
1 87 42 66 90 45 20 41 30 32 18 98 72 82 76  
10 28 68 57 98 54 87 66 7 84 20 25 29 72 33  
30 4 20 71 69 9 16 41 50 97 24 19 46 47 52 2  
56 80 89 65 29 42 51 94 1 35 65 25 15 88 5  
7 44 92 28 66 60 37 33 52 38 29 76 8 75 22 5  
9 96 30 38 36 94 19 29 44 12 29 30 77 5 44 6  
4 14 39 7 41 5 19 29 89 70 18 18 97 25 44 71  
84 91 100 73 26 45 91 6 40 55 87 70 83 43 6  
5 98 8 56 5 49 12 23 29 100 44 47 69 41 23 1  
2 11 6 2 62 31 79 6  
System call failed:-1  
System call failed:-1  
System call failed:-1  
Process ID of the calling process= 268  
Real user ID= 0  
Effective user ID= 0  
Current date/time =-1  
Current date/time: 02-18-2019/02:33:43  
Child exited with status 0
```

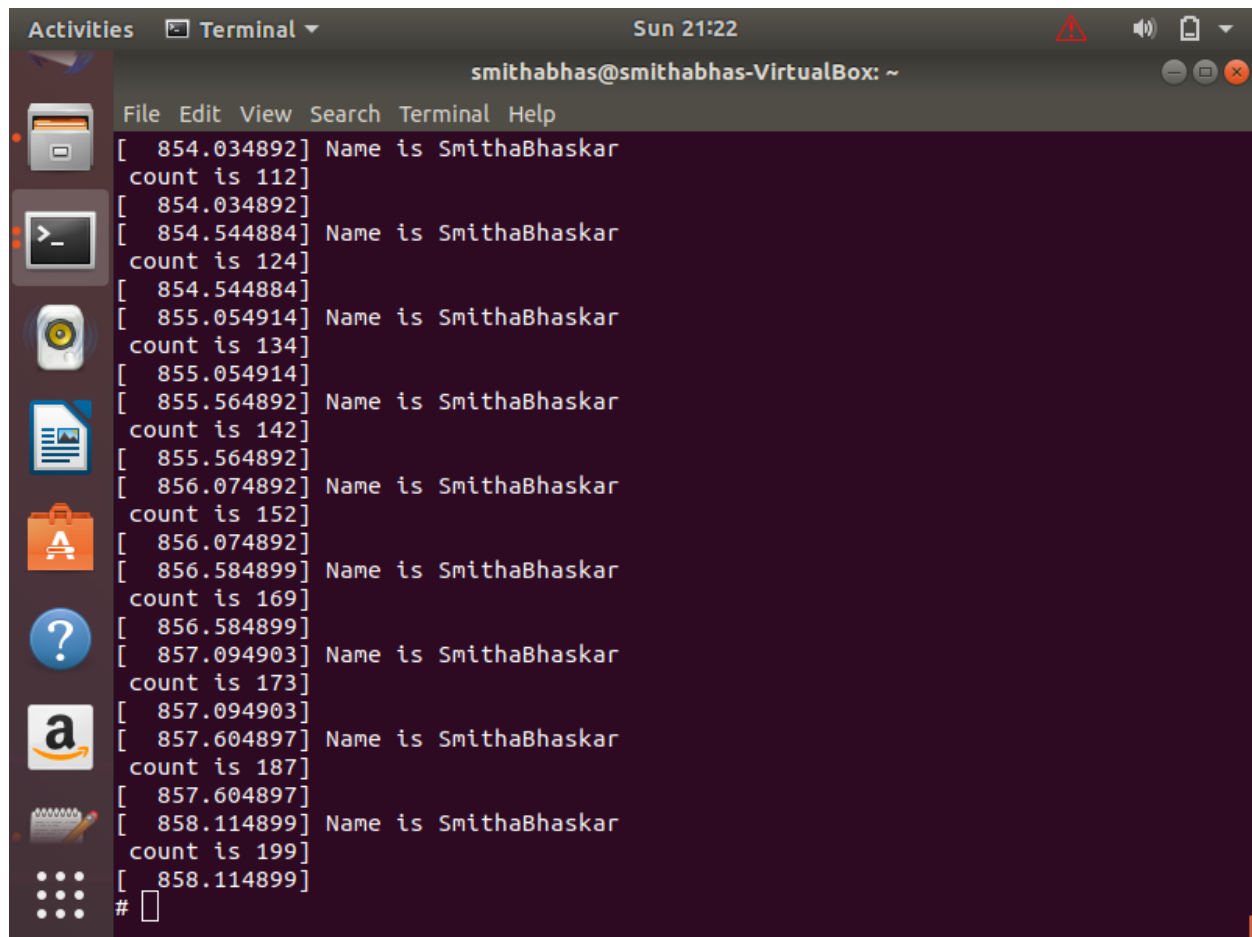
gdb-multiarch



```
smithabhas@smithabhas-VirtualBox: ~  
File Edit View Search Terminal Help  
smithabhas@smithabhas-VirtualBox:~$ gdb-multiarch -x gdbinit  
GNU gdb (Ubuntu 8.1.0-0ubuntu3) 8.1.0.20180409-git  
Copyright (C) 2018 Free Software Foundation, Inc.  
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>  
This is free software: you are free to change and redistribute it.  
There is NO WARRANTY, to the extent permitted by law. Type "show copying"  
and "show warranty" for details.  
This GDB was configured as "x86_64-linux-gnu".  
Type "show configuration" for configuration details.  
For bug reporting instructions, please see:  
<http://www.gnu.org/software/gdb/bugs/>.  
Find the GDB manual and other documentation resources online at:  
<http://www.gnu.org/software/gdb/documentation/>.  
For help, type "help".  
Type "apropos word" to search for commands related to "word".  
gdbinit: No such file or directory.  
(gdb)   

```

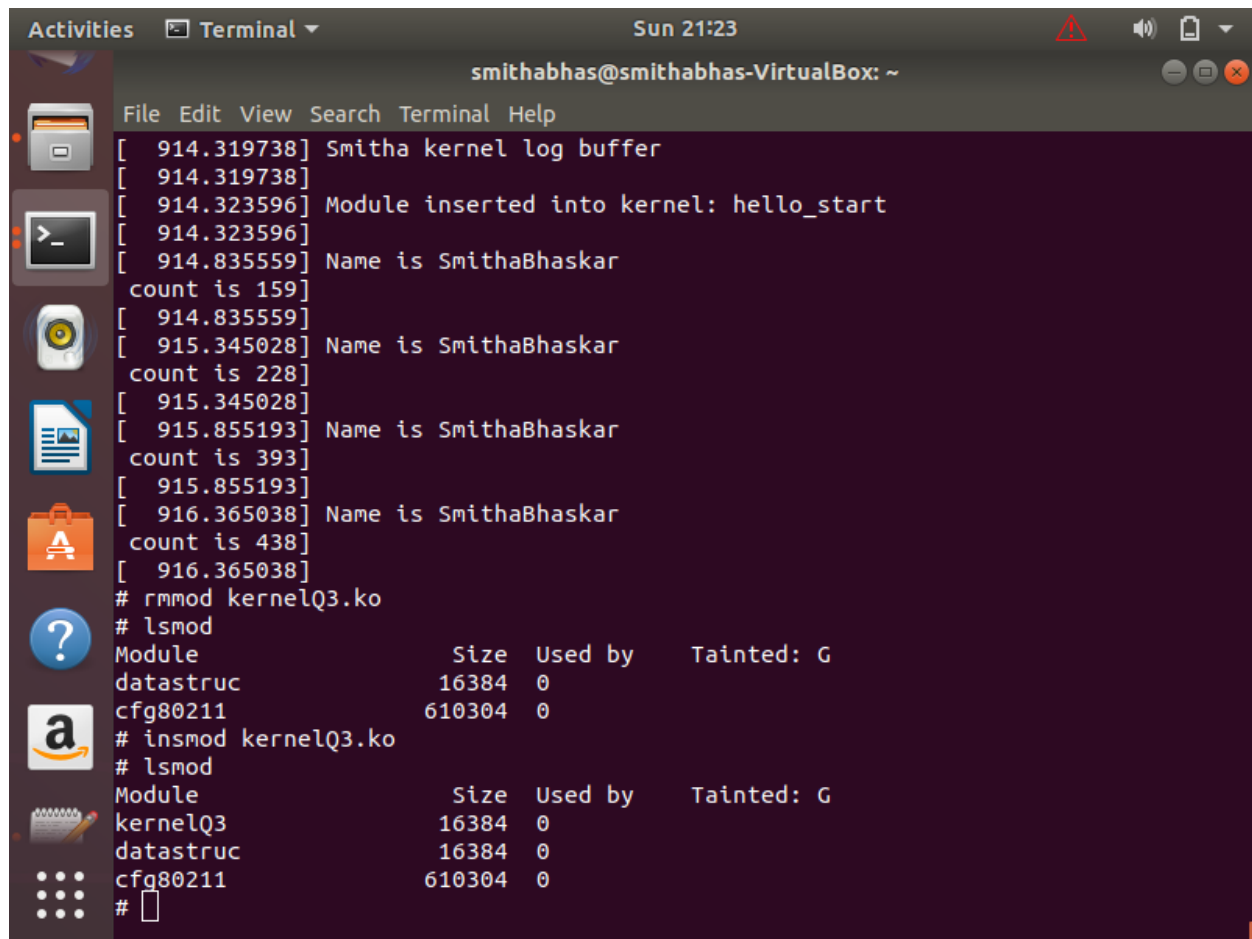
q3:



A terminal window titled "smithabhas@smithabhas-VirtualBox: ~" with a menu bar (File, Edit, View, Search, Terminal, Help) and a sidebar with application icons. The terminal displays a series of output lines from a program, each consisting of a timestamp in brackets, the name "SmithaBhaskar", and a count. The counts increase from 112 to 199. The window title bar shows "Sun 21:22" and system icons for warning, volume, and network.

```
smithabhas@smithabhas-VirtualBox: ~
[ 854.034892] Name is SmithaBhaskar
count is 112]
[ 854.034892]
[ 854.544884] Name is SmithaBhaskar
count is 124]
[ 854.544884]
[ 855.054914] Name is SmithaBhaskar
count is 134]
[ 855.054914]
[ 855.564892] Name is SmithaBhaskar
count is 142]
[ 855.564892]
[ 856.074892] Name is SmithaBhaskar
count is 152]
[ 856.074892]
[ 856.584899] Name is SmithaBhaskar
count is 169]
[ 856.584899]
[ 857.094903] Name is SmithaBhaskar
count is 173]
[ 857.094903]
[ 857.604897] Name is SmithaBhaskar
count is 187]
[ 857.604897]
[ 858.114899] Name is SmithaBhaskar
count is 199]
[ 858.114899]
#
```

lsmod:



A terminal window titled 'smithabhas@smithabhas-VirtualBox: ~' showing the execution of kernel module commands. The output includes timestamps and messages for inserting and removing the 'kernelQ3.ko' module, and the output of the 'lsmod' command showing loaded modules and their dependencies.

```
smithabhas@smithabhas-VirtualBox: ~
[ 914.319738] Smitha kernel log buffer
[ 914.319738]
[ 914.323596] Module inserted into kernel: hello_start
[ 914.323596]
[ 914.835559] Name is SmithaBhaskar
count is 159
[ 914.835559]
[ 915.345028] Name is SmithaBhaskar
count is 228
[ 915.345028]
[ 915.855193] Name is SmithaBhaskar
count is 393
[ 915.855193]
[ 916.365038] Name is SmithaBhaskar
count is 438
[ 916.365038]
# rmmod kernelQ3.ko
# lsmod
Module                Size  Used by    Tainted: G
datastruc             16384    0
cfg80211             610304    0
# insmod kernelQ3.ko
# lsmod
Module                Size  Used by    Tainted: G
kernelQ3              16384    0
datastruc             16384    0
cfg80211             610304    0
#
```

modinfo:

```
root@beaglebone:/# ls
bin  dev  hashtable.ko  ID.txt  lost+found  mnt          opt  root  sbin  sys  usr
boot  etc  home          lib      media       nfs-uEnv.txt  proc  run   srv   tmp  var
root@beaglebone:/# modinfo hashtable.ko
filename:           //hashtable.ko
description:        Basic animal sorting execution
author:             Smitha Bhaskar
license:            GPL
srcversion:         735D8AF416FC45BAE6A1027
depends:
name:               hashtable
vermagic:           4.14.40 SMP mod_unload modversions ARMv6 p2v8
parm:               name:charp
parm:               count:ulong
```

q4:

```
smithabhas@smithabhas-VirtualBox: ~  
File Edit View Search Terminal Help  
elephant elephant elephant elephant elephant elephant elephant elephant elephant  
elephant elephant elephant elephant elephant elephant elephant elephant elephan  
t elephant elephant elephant elephant elephant elephant elephant elephant eleph  
ant elephant elephant elephant elephant elephant elephant elephant lion lion lion m  
ice mice mice mice mice mice mice mice mice mice mice mice mice panda panda pan  
da panda panda panda panda panda panda panda panda panda panda panda pigeon pig  
eon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeo  
n pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon  
pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pi  
geon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pigeon pi  
[ 7162.987311] 2 -cat  
[ 7162.987311]  
[ 7162.987322] 12 -crow  
[ 7162.987322]  
[ 7162.991061] 2 -dog  
[ 7162.991061]  
[ 7162.995048] 42 -elephant  
[ 7162.995048]  
[ 7162.998783] 4 -lion  
[ 7162.998783]  
[ 7163.003106] 13 -mice  
[ 7163.003106]  
[ 7163.006933] 17 -panda  
[ 7163.006933]  
[ 7163.010847] 37 -pigeon  
[ 7163.010847]  
[ 7163.014893] 14 -tiger  
[ 7163.014893]  
[ 7163.018993] Element found: pigeon
```


Activities Terminal Sun 23:25 smithabhas@smithabhas-VirtualBox: ~

```
File Edit View Search Terminal Help
[ 460.903927]
[ 460.909856]
[ 460.911452]
[ 460.913009]
[ 460.914566]
[ 460.916120]
[ 460.917675] 2 -dog
[ 460.917675]
[ 460.917687] 900
[ 460.921552] do_init_module: 'hashtable'->init suspiciously returned 3, it sh
ould follow 0/-E convention
[ 460.921552] do_init_module: loading module anyway...
[ 460.938406] CPU: 0 PID: 178 Comm: insmod Tainted: G      0      4.14.40 #
13
[ 460.945950] Hardware name: Generic AM33XX (Flattened Device Tree)
[ 460.952349] [<c0110b98>] (unwind_backtrace) from [<c010c9fc>] (show_stack+0x
10/0x14)
[ 460.960450] [<c010c9fc>] (show_stack) from [<c0834120>] (dump_stack+0xb0/0xe
8)
[ 460.968004] [<c0834120>] (dump_stack) from [<c01e2be4>] (do_init_module+0x1d
0/0x1f8)
[ 460.976092] [<c01e2be4>] (do_init_module) from [<c01e4b7c>] (load_module+0x1
f08/0x2550)
[ 460.984452] [<c01e4b7c>] (load_module) from [<c01e53f4>] (Sys_finit_module+0
xa0/0xbc)
[ 460.992647] [<c01e53f4>] (Sys_finit_module) from [<c0107ec0>] (ret_fast_sysc
all+0x0/0x28)
#
```

```
[ 460.899696] 37 -pigeon
[ 460.899696]
[ 460.899705] 42 -elephant
[ 460.899705]
[ 460.903927]
[ 460.909856]
[ 460.911452]
[ 460.913009]
```